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UNITED STATES OF AMERICA

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TITLE: Dropped Deck Center Beam Rail Road Car

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT I, James W. Forbes
of 15 Glenron Road, R.R. #2, Campbellville, Ontario, Canada L0P 1B0,
Citizen of Canada,
have invented a : **DROPPED DECK CENTER BEAM RAIL ROAD CAR**
of which the following is a specification.

DROPPED DECK CENTER BEAM RAIL ROAD CAR

FIELD OF THE INVENTION

This invention relates generally to center beam rail road cars, and, in particular, to center beam cars having a depressed deck portion between a pair of rail car trucks.

BACKGROUND OF THE INVENTION

Center beam rail road cars, in cross-section, generally have a rack-like body, namely a center beam structure in the shape of an I in which the top flange is narrower than the bottom flange. The center beam structure is carried on a pair of rail car trucks. The rack, or center beam structure, has a pair of bulkheads at either longitudinal end that extend transversely to the rolling direction of the car. The lading supporting structure of the beam includes laterally extending decking mounted above, and spanning the space between, the trucks. A center beam web structure, typically in the nature of an open frame truss for carrying vertical shear loads, stands upright from the deck and runs along the longitudinal centerline of the car between the end bulkheads. This kind of webwork structure can be constructed from an array of parallel uprights and appropriate diagonal bracing. Most often, a top truss assembly is mounted on top of the vertical web and extends laterally to either side of the centerline of the car. The top truss is part of an upper beam assembly, (that is, the upper or top flange end of the center beam) and is usually manufactured as a wide flange, or wide flange-simulating truss, both to co-operate with the center sill to resist vertical bending, and also to resist bending due to horizontal loading of the car while travelling on a curve. Typically, a center sill extends the length of the car. The center beam thus formed is conceptually a deep girder beam whose bottom flange is the center sill, and whose top flange is the top truss (or analogous structure) of the car.

Center beam cars are commonly used to transport packaged bundles of lumber, although other loads such as pipe, steel, engineered wood products, or other goods can also be carried. The space above the decking and below the lateral wings of the top truss on each side of the vertical web of the center beam forms left and right bunks upon which bundles of wood can be loaded. The base of the bunk generally includes risers that are mounted to slant inward, and the vertical web of the center beam is generally tapered from bottom to top, such that when the bundles are stacked, the overall stack leans inward toward the longitudinal centerline of the car.

Lading is most typically secured in place using straps or cables. Generally, the straps extend from a winch device mounted at deck level, upward outside the bundles, to a top

fitting. The top fitting can be located at one of several intermediate heights for partially loaded cars. Most typically, the cars are fully loaded and the strap terminates at a fitting mounted to the outboard wing of the upper beam assembly. Inasmuch as the upper beam assembly is narrower than the bundles, when the strap is drawn taut by tightening the winch, it binds on the upper outer corner of the topmost bundle and exerts a force inwardly and downwardly, tending thereby to hold the stack in place tight against the center beam web.

Each bundle typically contains a number of pieces of lumber, commonly the nominal 2" x 4", 2" x 6", 2" x 8" or other standard size. The lengths of the bundles vary, typically ranging from 8' to 24', in 2' increments. The most common bundle size is nominally 32 inches deep by 49 inches wide, although 24 inch deep bundles are also used, and 16 inch deep bundles can be used, although these latter are generally less common. A 32 inch nominal bundle may contain stacks of 21 boards, each 1 - 1/2 inch thick, making 31 - 1/2 inches, and may include a further 1 - 1/2 inches of dunnage for a total of 33 inches. The bundles are loaded such that the longitudinal axes of the boards are parallel to the longitudinal, or rolling, axis of the car generally. The bundles are often wrapped in a plastic sheeting to provide some protection from rain and snow, and also to discourage embedment of abrasive materials such as sand, in the boards. The bundles are stacked on the car bunks with the dunnage located between the bundles such that a fork-lift can be used for loading and unloading. For bundles of kiln dried softwood lumber the loading density is taken as 1600 to 2000 Lbs. per 1000 board-feet.

It has been observed that when the straps are tightened, the innermost, uppermost boards of the topmost bundle bear the greatest portion of the lateral reaction force against the center beam due to the tension in the straps or cables. It has also been observed that when these bundles bear against the vertical posts of the center beam, the force is borne over only a small area. As the car travels, it is subject to vibration and longitudinal inertia loads. Consequently the plastic sheeting may tend to be torn or damaged in the vicinity of the vertical posts, and the innermost, uppermost boards can be damaged. The physical damage to these boards may tend to make them less readily saleable. Further, whether or not the boards are damaged, if the plastic is ripped, moisture can collect inside the sheeting. This may lead to the growth of molds, and may cause discolouration of the boards. In some markets the aesthetic appearance of the wood is critical to its saleability, and it would be advantageous to avoid this discolouration.

In part, the difficulty arises because the bearing area may be too small. Further, the join between the upstanding web portion of the center beam and the upper beam assembly can coincide with the height of the topmost boards. This join is not always smooth. Further

still, when the posts are fabricated the flanges may not stand perfectly perpendicular to the web, such that one edge of the flange may bear harder against the bundles than another.

It is also desirable that the bundles stack squarely one upon another. Although it is possible to use wooden battens at the top end of the center beam web, this will tend to cause the top bundle to sit outwardly of its neighbours. It has been observed that a thin wooden batten, of 3/4" thickness may tend to bow inwardly between adjacent posts, and may not spread the wear load as much as may be desired. A 1 - 1/2 inch thick wooden batten may have a greater ability to resist this bowing effect. However, the space available for employing a batten may tend to be limited by the design envelope of the car. Inasmuch as is advantageous to load the car as fully as possible, and given that the design of the car may usually reflect a desire to maximize loading within the permissible operational envelope according to the applicable AAR standard, the use of a relatively thick wooden batten may tend to push the outside edge of the top bundle outside the permissible operational envelope. Wooden battens may also be prone to rotting if subject to excessive exposure to moisture, or may be consumable wear items that may require relatively frequent periodic replacement.

It would be desirable to have an upper beam assembly that is integrated into the structure, that is formed to spread the bearing load across a larger area, that would tend to resist the bowing phenomenon, that would tend not to require frequent replacement, and that would tend not to be prone to rotting.

Existing center beam cars tend to have been made to fall within the car design envelope, or outline, of the American Association of Railroads standard AAR Plate C, and tend to have a flat main deck that runs at the level of the top of the main bolsters at either end of the car. In U.S. Patent 4,951,575, of Dominguez et al., issued August 28, 1990, a center beam car is shown that falls within the design envelope of plate C, and also has a depressed center deck between the car trucks. It would be advantageous to be able to operate center beam cars that exceed Plate C and fall within AAR Plate F, with a full load of lumber in bundles stacked 5 bundles high. A five bundle high load of 33 inch bundles requires a vertical clearance in the left and right hand bunks of at least 165 inches. This significantly exceeds the vertical loading envelope of a plate C car.

Increased vertical loading to exceed Plate C, as in a Plate F car, may tend also to increase the height of the center of gravity of a loaded car above the allowable vertical center of gravity height limit of 98 inches measured from top-of-rail (TOR). Consequently it may be desired to drop the center portion of the deck further to once again lower the center of gravity. However, as the deck is dropped further, the deck must also become narrower to

remain within the AAR design envelope, whether of Plate C or Plate F. Further still, when the truck centers of the car exceed 46 ft. 3 in., the mid-span car width must be reduced due to swing out as the car travels through corners. That is, the car must lie within the design envelope of a 10'- 8" wide car with 46' – 3" truck centers, on a 13° curve (equivalent to a track center radius of 441.7 ft.). For a car having a nominal length of 73 ft, and a 56 ft well, will probably have a distance between truck centers of the order of 67 or 68 ft. The allowance for swing out, (that is, the reduction in width to match a car having 46' – 3" truck centers), for such a car is significant.

As the allowable car width becomes narrower, either due to increasing the truck centers beyond 46 ft. 3 in., or due to lowering the height of the decking, it is highly desirable to retain as much of the remaining lateral width as possible to support the bundles. Moreover, it has become desirable to provide a bunk width sufficient to carry 51 inch wide bundles, as well as 49 inch wide bundles. In the past, as shown in U.S. Patent 4,951,575 winches have been installed outboard of the side sills at longitudinal stations corresponding to the longitudinal stations of the outboard ends of the cross bearers. These winches are used to cinch the strapping that is used to secure the load to the center beam top compression member wings, or, in the case of a partially loaded car, to the center beam main vertical web assembly. The winches tend to extend further laterally outboard, relative to the longitudinal centerline, than any other part of the car. Given the inwardly angled profile of the lower portions of the Plate C and Plate F envelopes, each incremental decrease in overall car width measured from the centerline to the outboard extremity of the winch permits an incremental lowering of the loaded center of gravity of the car. Consequently, it is advantageous to make the winch mounting as laterally compact as possible.

In known center beam cars, such as those shown in U.S. Patent 4,951,575 and in U.S. Patent 4,802,420 of Butcher et al., issued February 7, 1989, the deck structure of the cars has included inwardly tapering risers mounted above the cross bearers, with longitudinally extending side sills running along the ends of the cross-bearers. The side sills have been angle or channel sections. In U.S. Patent 4,951,575 the side sills are z-sections with the upper leg of the Z extending outward, the lower leg extending inward, and the web between the two legs running vertically. In U.S. Patent 4,802,420 of Butcher et al., the side sill is a channel section, with the legs extending laterally outward and the web, being the back of the channel, extending vertically between the two legs. In both cases the winch is mounted outward of the vertical web.

In center beam cars it is desirable that the main center sill be aligned with the couplers to reduce or avoid eccentric draft or buff loads from being transmitted. In dealing with lateral loads, the side sills act as opposed flanges of a beam. The loads in the side sills, whether in tension, compression, vertical shear or lateral bending, tend to be transferred to the main sill through a main bolster assembly at each end of the car. In general the bolster is located at a level corresponding to the height of the main sill, and the shear plate, if one is used, is typically at a level corresponding to the level of the upper flange of the main sill.

It is desirable to have a well deck, also called a depressed center deck or dropped deck, between the trucks, to increase the load that can be carried, and so to increase the overall ratio of loaded weight to empty weight of the car, and also to reduce the height of the center of gravity of the car when loaded, as compared to a car having a flat, straight-through deck from end to end carrying the same load. In the case of a well deck, compression and tension loads in the side sills must be carried from the level of the side sills in the well, to the level of the side sills over the trucks, and then through the bolster structure and into the main sill. The transmission of forces through the vertical distance of the eccentricity of the rise in the side sills from the well to the bolster results in the generation of a moment. When the side sill has a knee at the transition from the well to the end structure of the car, the height of the knee defines the arm of the moment. It is advantageous not to create an unnecessarily large moment couple, and hence to keep the knee height small.

The coupler height of rail road cars is 34 1/2" above top of rail (TOR). This is a standard height to permit interchangeable use of various types of rail cars. The main sill, or stub sill if used, tends to have a hollow box or channel section, the hollow acting as a socket into which the coupler is mounted. The minimum height of the main sill at the trucks (or stub sill, if one is used) and end structure bolsters tends to be determined by the coupler height, and the height required to clear the wheels. The height of the well deck is limited by the design envelope, be it Plate C, Plate F, or some other. In general, however, the height of the shear plate, or top flange of the bolster, to the well decking is less than the desired 33 inch bundle height. It is desirable for the top of the first layer of bundles stacked in the well to be at a height that permits the next layer of bundles to match the height of bundles stacked over the trucks. Consequently it would be advantageous to have a false deck, or staging, mounted above the shear plate, or if there is no end structure shear plate, then above the bolster, at a level to match the level of the top of the bundles carried in the well between the trucks.

One way to reduce the stress concentration at the knee is to make the side sill section of the end portion of the sill deeper. Another way to reduce the stress concentration at the knee is to make the knee member wider. On the longitudinally inwardly facing side of the knee (that is, the side oriented toward the lading in the well) the flange of the vertical leg of the knee may tend to extend perpendicularly. On the longitudinally outboard side, that is, the side facing the truck, the longitudinally outboard flange can be angled, or swept, resulting in a tapering leg, rather than one with parallel flanges. An increase in the section width, due to tapering the longitudinally outboard flange is desirable, as it permits a reduction in the stress concentration in the side sill assembly at the knee, and tends to provide greater truck clearance.

It may also be desirable or advantageous to be able to adjust the height of the structure over the bolster under circumstances where loads other than 33 inch bundles of lumber are carried, either by raising or lowering the staging to a different height, or lowering or removing it altogether such that the load is borne through the bolster and shear plate structure.

SUMMARY OF THE INVENTION

In an aspect of the invention there is a center beam railroad car having a longitudinal centerline. The railroad car is supported by rail car trucks at either end thereof. The railroad car comprises a cargo support structure borne between the trucks, upon which cargo can be carried. There is a web work assembly including an array of posts mounted along the longitudinal centerline of the rail road car. The array extends upwardly of the cargo support structure, and the array is braced longitudinally. An upper beam assembly surmounts the web work assembly. The upper beam assembly has cantilevered wings extending laterally of the longitudinal centerline. The railroad car has a load limit height defined at a level measured upwardly from the cargo support structure, and has a nominal load height that is equal to the largest integer multiple of 33 inches that is less than the load limit height. The web work assembly has at least one skirt member mounted thereto to define a longitudinally extending face against which loads placed laterally outward thereof can bear. The skirt member extends from a first height that is at least as high as the nominal load height to a second height that is at least as low as a height that is six inches below the nominal load height.

In another aspect of the invention there is a center beam car having a longitudinal centerline. The center beam car is supported by rail car trucks at either end thereof. The center beam rail car has a center sill extending between the trucks. There is a decking structure extending laterally of the center sill upon which loads can be placed. An open truss

structure extends upwardly from the center sill. An upper beam assembly is mounted upon the open truss structure. The upper beam structure includes laterally extending wing portions and a vertical stem portion. The stem portion is mounted to the open truss structure at a joining interface, and the laterally extending wing portions are mounted to the stem. The stem includes a pair of longitudinally extending, laterally spaced apart, skirt members. The skirt members each have an outwardly facing surface against which cargo placed laterally outboard thereof can bear. The center beam car has an upper load limit height defined at a level between the decking structure and the laterally extending wings. The skirts are located to overlap the load limit height. The outside lateral dimension of the stem matches the overall outside dimension of the open truss structure at the joining interface.

In another aspect of the invention there is a center beam car having a longitudinal centerline. The center beam car is supported by rail car trucks at either end thereof. The center beam railroad car has a center sill extending between the trucks, a decking structure extending laterally of the center sill upon which loads can be placed, an open truss structure extending upwardly from the center sill and an upper beam assembly mounted upon the open truss structure. The upper beam structure includes laterally extending wing portions. The open truss structure has a pair of longitudinally extending, laterally spaced apart, skirt members mounted thereto. The skirt members each have an outwardly facing surface against which cargo placed laterally outboard thereof can bear. The center beam car has an upper load limit height defined at a level between the decking structure and the laterally extending wings. The skirts are located to overlap the load limit height. The skirts have at least one reinforcement mounted laterally inboard thereof to discourage lateral deflection of the faces when cargo placed laterally outward thereof bears against the skirts.

In a further aspect of the invention, there is a rail road car having a longitudinal centerline. It comprises a pair of rail car trucks and a center beam assembly carried thereupon. The center beam assembly has a lower flange assembly, an upper flange assembly, and a web assembly extending between the upper and lower flange assemblies. The web assembly has a plurality of upwardly extending posts. The posts have a lower region and an upper region. The web assembly has a non-consumable skirt mounted to the upper region of the posts. The skirt presents a bearing surface. The bearing surface faces laterally outward relative to the longitudinal centerline of said rail road car. Cargo can bear against the bearing surface.

In another aspect of the invention there is a center beam rail road car having a center beam car body mounted on a pair of first and second spaced apart rail car trucks. The body has a deck structure and a central vertical web assembly running along the car.

The vertical web assembly extends upwardly of the deck structure. A top truss assembly surmounts the vertical web assembly. The deck structure includes first and second end decking portions mounted over the respective first and second trucks, and a medial decking portion lying between the trucks. The medial decking portion is stepped downward relative to the first and second end decking portions. The top truss assembly is mounted at a height exceeding AAR Plate C.

In an additional feature, the body has a bunk defined between the deck structure and the top truss. The bunk has a loading height measured between the medial decking portion and the top truss that is at least 165 inches. In another additional feature, the car has a center sill. The deck structure is supported thereby. The web assembly includes an array of posts extending upwardly from the main sill and has an upper region adjacent to the top truss and a lower region adjacent to the decking structure. The upper region of the web assembly has at least one longitudinally extending skirt against which lading can be placed.

In still another additional feature, the car has a center sill. The deck structure is supported thereby. The web assembly includes an array of posts extending upwardly from the main sill and has a lower region adjacent to the decking structure and an upper region distant therefrom. The car has an upper beam assembly. The upper beam assembly includes the top truss and a beam stem. The top truss is mounted upon the beam stem and the beam stem is mounted to the upper region of the web assembly. The beam stem includes at least one longitudinally extending skirt against which lading can be placed.

In yet another additional feature, the medial decking portion lying between the two trucks is at least 28' - 0" long. In a further additional feature, the medial decking portion lying between the two trucks is at least 40' - 0" long. In still a further additional feature, when loaded with lumber having a density of up to 1740 Lbs./ft.^{3}, if fully loaded, the rail car has a center of gravity falling within a range whose upper limit is 98 inches above top of rail.

In another additional feature, the end decking portions and the medial decking portion each have a load bearing interface, and the load bearing interface of the end decking portions is stepped upwardly relative to the load bearing interface of the medial decking portion a distance of at least 30 inches. In still another additional feature, at least one of the end decking portions has staging mounted thereon to define a load bearing interface spaced upwardly of at least one end decking portion. In yet another additional feature, the staging is moveable to a storage position. In an additional feature, the car has a pair of side sills extending along the deck structure. The side sills each have a medial

side sill portion mounted to the medial decking portion. The medial side sill portion has a first depth of section. The side sills each have end side sill portions mounted to the end decking structures. The end side sill portions have a second depth of section. The first depth of section is less than the second depth of section.

In still another additional feature, the end decking portions include lading support structure mounted thereon defining an end section lading interface. The end section lading interface lies at a height greater than 42 inches above top of rail. In yet another additional feature, the car has a pair of side sills extending along the deck structure. The side sills each have a medial side sill portion mounted to the medial decking portion. The medial side sill portion has a first depth of section. The side sills each have end side sill portions mounted to the end decking structures. The end side sill portions have a second depth of section. The first depth of section is less than the second depth of section.

In still yet another additional feature, the car has a pair of side sills extending along the deck structure. The side sills each have a side sill medial portion mounted to the medial decking portion. The medial side sill portion has a first depth of section. The side sills each have side sill end portions mounted to the end decking structures. The end side sill portions have a second depth of section. Each of the side sills has a knee joining the side sill medial portion to each of the side sill end portions. Each knee has a longitudinally inboard flange, a longitudinally outboard flange, and webbing extending therebetween. The longitudinally outboard flange has a lower extremity and an upper extremity. The lower extremity lies at a longitudinally inboard station relative to the upper extremity.

In another additional feature, the car has a pair of side sills extending along the deck structure. The side sills each have a medial side sill portion mounted to the medial decking portion. The side sills each have end side sill portions mounted to the end decking structures. The medial side sill portion has a medial portion side sill web extending from a first edge to a second edge. The first edge lies at a greater height than the second edge, and the first edge lies a further distance transversely outboard than the second edge. In yet another additional feature, the medial decking portion has at least one lading securement apparatus mounted to the medial portion side sill web.

In another aspect of the invention, there is a center beam rail road car having a longitudinal centerline and a pair of ends. The rail road car is supported by rail car trucks at either end thereof. The rail road car has a cargo support structure borne between the trucks, upon which cargo can be carried. The cargo support structure includes a pair of first and

second end structures each mounted over a respective one of the trucks, and a medial structure mounted between the trucks. The medial structure is stepped downwardly relative to the end structures. A web assembly includes an array of spaced apart posts mounted at intervals along the longitudinal centerline of the rail road car. The array extends upwardly of the cargo support structure. An upper beam assembly surmounts the web assembly. The upper beam assembly has cantilevered wings extending laterally of the longitudinal centerline. The railroad car has a load limit height defined at a level measured upwardly from the medial structure, and having a nominal load height that is at least as great as the largest integer multiple of 33 inches that is less than the load limit height. The web assembly has at least one skirt member against which loads placed laterally outward thereof can bear. The skirt member extends between a first height and a second height straddling the nominal load height.

In an additional feature of this aspect of the invention, the skirt extends a longitudinal distance corresponding to at least one of the intervals. In another additional feature, the first height is at least as great as the load limit height, and the second height is at least 6 inches below the nominal load height.

In another aspect of the invention, there is a center beam rail road car having a center beam car body mounted on a pair of first and second spaced apart rail car trucks. The body has a deck structure and a central vertical web assembly running along the car. The vertical web assembly extends upwardly of the deck structure. A top truss assembly surmounts the vertical web assembly. The deck structure includes first and second end decking portions mounted over the respective first and second trucks. The first and second end decking portions have structural members presenting respective first and second end portion load bearing interfaces, and a medial decking portion lying between the trucks. The medial decking portion has at least one member presenting a medial load bearing interface. The medial load bearing interface is stepped downward relative to the first portion load bearing interface through a step distance. The step distance is greater than 30 inches.

In another aspect of the invention, there is a center beam rail road car having a center beam car body mounted on a pair of first and second spaced apart rail car trucks. The body has a deck structure and a central vertical web assembly running along the car between the ends. The vertical web assembly extends upwardly of the deck structure. A top truss assembly surmounts the vertical web assembly. The deck structure includes first and second end decking portions mounted over the respective first and second trucks and

a medial decking portion lying between the trucks. The medial decking portion is stepped downward relative to the first and second end decking portions. At least one of the first and second end deck portions has staging mounted thereupon. The staging has a load support member spaced upwardly of at least one first and second end deck portions.

In another aspect of the invention there is a center beam rail road car having a center beam car body mounted on a pair of first and second spaced apart rail car trucks. The body has a deck structure and a central vertical web assembly running along the car between the ends. The vertical web assembly extends upwardly of the deck structure. A top truss assembly surmounts the vertical web assembly. The deck structure includes first and second end decking portions mounted over the respective first and second trucks. A medial decking portion lies between the trucks. The medial decking portion is stepped downwardly relative to the first and second end decking portions. The deck structure has laterally outboard side sills running therealong. Each of the side sills has first and second end decking side sill portions mounted to respective ones of the first and second end decks, and a medial side sill portion mounted to the medial deck portion. The medial deck portion is joined to the end deck portions by knee braces. Each of the knee braces has a longitudinally inboard flange adjacent to the medial portion. The inboard flange extends vertically and each of the knee braces has a longitudinally outboard flange. The longitudinally outboard flange extends from a lower portion thereof lying at a first height relative to top of rail, to an upper portion thereof lying at a second, greater, height relative to top of rail. The upper portion lies further from the longitudinally inboard flange than the lower portion.

In another aspect of the invention, there is a center beam rail road car having a center beam car body mounted on a pair of first and second spaced apart rail car trucks. The body has a deck structure and a central vertical web assembly running along the car. The vertical web assembly extends upwardly of the deck structure. A top truss assembly surmounts the vertical web assembly. The deck structure includes first and second end decking portions mounted over the respective first and second trucks, and a medial decking portion lying between the trucks. The medial decking portion is stepped downward relative to the first and second end decking portions. The medial decking portion has a pair of medial decking side sills mounted therealong. Each of the side sills has a web. The web has an upper edge and a lower edge. The upper edge lies further outboard than the lower edge. In an additional feature, the medial decking side sill has a load securing device mounted transversely outboard thereof.

In another additional feature, at least one of the end decking portions has an end decking side sill. The end decking side sill has a web. The end decking side sill web has an upper edge and a lower edge, and the upper edge of the end decking side sill web lies further outboard than the inner edge thereof.

In another additional feature, the medial decking side sill portion is inclined at a first angle relative to the vertical, and the end decking side sill web is inclined at a second angle relative to the vertical. The first angle is greater than the second angle. In still another additional feature, the end decking side sill web has a load securing device mounted transversely outboard thereof.

In another aspect of the invention, there is a center beam rail road car having a center beam car body mounted on a pair of first and second spaced apart rail car trucks. The body has a deck structure and a vertical web assembly running along the car. The vertical web assembly extends upwardly of the deck structure. A top truss assembly surmounts the vertical web assembly. The deck structure includes first and second end decking portions mounted over the respective first and second trucks, and a medial decking portion lies between the trucks. The medial decking portion is stepped downward relative to the first and second end decking portions. The medial decking portion has a pair of medial decking side sills mounted therealong. At least one of the end decking portions has a pair of end decking side sills mounted therealong. The end decking side sills have a greater depth of section than the medial decking side sills.

In another aspect of the invention, there is a center beam rail road car having a center beam car body mounted on a pair of first and second spaced apart rail car trucks. The body has a center sill and a deck structure extending outboard of the center sill. A vertical web assembly runs along the car. The vertical web assembly extends upwardly of the center sill structure. A top truss assembly surmounts the vertical web assembly. The top truss lies at a height exceeding AAR Plate C. The deck structure includes first and second end decking portions mounted over the respective first and second trucks. A medial decking portion lies between the trucks. The medial decking portion is stepped downward relative to the first and second end decking portions. At least one of the end decking portions has a cargo support interface lying at a level greater than 42 inches above top of rail.

In another aspect of the invention, there is a center beam rail road car having a center beam car body mounted on a pair of first and second spaced apart rail car trucks. The body has a center sill having an upper flange and a lower flange. A deck structure

extends outboard of the center sill. A vertical web assembly runs along the car. The vertical web assembly extends upwardly of the center sill structure. A top truss assembly surmounts the vertical web assembly. The top truss lies at a height exceeding AAR Plate C. The deck structure includes first and second end decking portions mounted over the respective first and second trucks, and a medial decking portion lying between the trucks. The medial decking portion is stepped downward relative to the first and second end decking portions. At least one of the end decking portions has a cargo support interface lying at a greater height than the upper flange of the center sill.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure **1** shows an isometric, general arrangement view of a center beam rail road car having a depressed center deck;

Figure **2a** shows a side view of one half of a center beam rail road car similar to the center beam car of Figure **1**;

Figure **2b** shows an alternate configuration of car to that shown in Figure **2a**;

Figure **2c** shows an alternate configuration of car to that shown in Figure **2a**;

Figure **2d** shows an alternate configuration of car to that shown in Figure **2a**;

Figure **2e** shows an alternate configuration of car to that shown in Figure **2a**;

Figure **2f** shows an alternate configuration of car to that shown in Figure **2a**;

Figure **2g** shows a side view of one half of an alternate center beam rail road car to the center beam rail road car of Figure **1**;

Figure **3a** shows a perspective view of a detail of a deck transition section of the center beam car of Figure **2a**;

Figure **3b** shows an alternative to the transition section of Figure **3a**;

Figure **3c** shows an alternative, removable, load supporting structure for an end section of a center beam car otherwise similar to the rail car of Figure **2a**;

Figure **3d** shows an alternative, collapsible load supporting structure for an end section of a center beam railroad car similar to the car of Figure **2a**;

Figure **3e** shows an isometric view of a detail of a deck transition of the center beam rail road car of Figure **2g**;

Figure **4a** shows a half-section of the car of Figure **2a** taken on section '**4a - 4a**';

Figure **4b** shows a half-section of the car of Figure **2a** taken on section '**4b - 4b**';

Figure **4c** shows a half-section of an end deck taken on section '**4c – 4c**' looking toward a cross-tie of the car of Figure **2a**;

Figure **4d** shows a cross-section of an end deck taken on section '**4d – 4d**' looking toward the main bolster of the car of Figure **2a**;

Figure **4e** shows an enlarged detail of the cross-section of Figure **4a**;

Figure **5a** shows a cross-section of the car of Figure **2g** taken on section '**5a - 5a**';

Figure **5b** shows a cross-section of the car of Figure **2g** taken on section '**5b - 5b**';
Figure **5c** shows a cross-section of the car of Figure **2g** taken on section '**5c – 5c**' looking toward the main bolster;
Figure **5d** shows a cross-section of the car of Figure **2g** taken on section '**5d – 5d**';
Figure **5e** shows a cross-section of the car of Figure **2g** taken on section '**5e – 5e**';
Figure **6a** shows an enlarged detail of Figure **5a**;
Figure **6b** shows an enlarged detail of Figure **5b**;
Figure **6c** shows an enlarged detail of Figure **5c**;
Figure **6d** shows an enlarged detail of Figure **5d**;
Figure **6e** shows an enlarged detail of Figure **5e**;
Figure **7a** shows a detail of the upper beam structure of the car of Figure **2a**;
Figure **7b** shows a side sectional view of the detail of Figure **7a**;
Figure **8a** shows an alternate detail to that of Figure **7a**;
Figure **8b** shows a side sectional view of the detail of Figure **8a**;
Figure **9a** shows an alternate detail to that of Figure **7a**;
Figure **9b** shows a side sectional view of the detail of Figure **9a**;
Figure **10a** shows an alternate detail to that of Figure **7a**;
Figure **10b** shows a side sectional view of the detail of Figure **10a**;
Figure **11a** shows an alternate detail to that of Figure **7a**;
Figure **11b** shows a side sectional view of the detail of Figure **11a**;
Figure **12a** shows an alternate detail to that of Figure **7a**;
Figure **12b** shows a side sectional view of the detail of Figure **12a**;
Figure **13** shows an alternate detail to that of Figure **7a**;
Figure **14** shows an alternate detail to that of Figure **7a**;
Figure **15a** shows an alternate detail to that of Figure **7a**;
Figure **15b** shows an alternate detail to that of Figure **15a**;
Figure **15c** shows an alternate detail to that of Figure **15a**;
Figure **15d** shows an alternate detail to that of Figure **15c**;
Figure **15e** shows an alternate detail to that of Figure **15c**;
Figure **15f** shows an alternate detail to that of Figure **15d**;
Figure **16** shows an alternate detail to that of Figure **7a**;
Figure **17** shows an alternate detail to that of Figure **7a**;
Figure **18** shows an alternate detail to that of Figure **7a**; and
Figure **19** shows an alternate detail to that of Figure **7a**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The description which follows, and the embodiments described therein, are provided by way of illustration of an example, or examples of particular embodiments of the principles of the present invention. These examples are provided for the purposes of

explanation, and not of limitation, of those principles and of the invention. In the description which follows, like parts are marked throughout the specification and the drawings with the same respective reference numerals. The drawings are not necessarily to scale and in some instances proportions may have been exaggerated in order more clearly to depict certain features of the invention.

A center beam railroad car is indicated in Figure **1** generally as **20**. It has a center beam rail road car body **21** carried on a pair of longitudinally spaced apart railroad car trucks **22** and **23** and operable to roll in a rolling, direction along rails in the generally understood manner of rail cars. Car **20** has a longitudinal centerline **25** lying at the center of the coupler height and in a longitudinal plane of symmetry, indicated generally as **24**, which intersects the kingpin connections of trucks **22** and **23**. Car **20** has a deck structure **26** that has end deck portions **27, 28** and a medial deck portion **29**, carried between the trucks at a height, relative to the top of rail (TOR) that is lower than the height of the end deck portions **27, 28**.

The structure of a center beam car is analogous to a deep beam having a tall central structure to approximate the web of a beam, or a web-like structure or truss assembly, a wide flange at the bottom, and a wide flange at the top. In the case of car **20**, the central web assembly is indicated generally as **30** and runs in the longitudinal direction (that is, the rolling direction of the car), the top flange function is served by a top truss assembly **32**, and the lower flange function is performed by an assembly that includes a lateral support structure **34**, in the nature of a deck, or frame, or staging upon which cargo can be placed, and that extends laterally outward to either side of a main center sill **36**, and main center sill **36** itself. Lateral support structure **34** generally includes deck structure **26**, and its outboard left and right hand side sills **42** and **44**.

It will be appreciated that aside from fittings such as hand grabs, ladders, brake fittings, and couplers, the structure of car **20** is symmetrical about the longitudinal plane of symmetry **24**, and also about a transverse plane of symmetry **31** at the mid-length station of the car. In that light, a structural description of one half of the car will also serve to describe the other half. The features of car **20** thus enumerated are basic structural features of a center beam car having a depressed center deck.

In detail, main center sill **36**, is a fabricated steel box beam that extends longitudinally along centerline **25** of car **20** throughout its length, having couplers **38** mounted at either end. Cross bearers **40** extend outwardly from center sill **36** to terminate at a pair of longitudinal left and right hand side sills **42, 44** that also run the length of the car. In the various embodiments of rail cars shown herein, cross-bearers are indicated as item **40**

and cross-ties are indicated as item **41**. These cross bearers and cross ties extend laterally outward from center still **36** on approximately 4 ft centers. Decking **46** is mounted to extend between cross-bearers **40**, and cross-ties **41** providing a shear connection between adjacent cross-bearers when side loads are imposed on the car. Structural members in the nature of tapered risers **48** are mounted above the cross-bearers to form the base of a bunk for carrying loads. Risers **48** are tapered so that loads stacked thereupon will tend to lean inwardly toward the center-line of car **20**. The upper surfaces of risers **48** define respective end decking portion and medial decking portion load-bearing interfaces. The combined structure of center sill **20**, cross-bearers **40**, and side sills **42, 44** and decking **46** provides a wide, lower beam or lower flange assembly extending laterally outward from the longitudinal centerline of car **20**.

As noted above, deck structure **26** has a first end portion, namely end deck portion **27**, a second end deck portion, namely end deck portion **28**, and a medial deck portion **29**. At each of the transitions from either end deck portion **27** or **28** to medial deck portion **29** there is a knee, indicated as either **47** or **49**. Not only is deck structure **26** stepped in this manner, but so too are side sills **42** and **44**, each having end members **41, 43**, and a medial span member **45**.

At either end of car **20** there are vertically upstanding fore and aft end bulkheads **50** and **52** which extend from side to side, perpendicular to the central longitudinal plane **24** of car **20**. Running the full length of car **20** between end bulkheads **50** and **52** is an array **54** of upright posts **56, 57**. Array **54** is reinforced by diagonal braces **58, 59**, that provide a shear path for vertical loads.

The array **54** of posts **56, 57** is surmounted by an upper beam assembly **60** and deep beam top chord assembly **62**. An open framework top truss **64** is mounted atop deep beam top chord assembly **62**. Truss **64** has lateral wings **65** and **67** that are mounted to extend outboard from the central plane of car **20** in a cantilevered manner. Truss **64** has longitudinal stringers **66**, cross members **68** and shear plates **69**.

As indicated in Figures **2a, 2b, 2c, 2d, 2e** and **2f**, there are many different possible configurations of posts and diagonal bracing. In Figure **2a**, a center beam railroad car with a depressed center deck is indicated as **70**. It has an array of vertical posts **72** that includes fabricated posts **73** having a generally H shaped section, and posts **74** having a generally C-channel shaped section, both type being more fully described below. The end bays have solid panels **75, 76** respectively. End diagonal struts **77, 78** extend

upwardly and longitudinally outboard away from the respective truck centers. Structural reinforcement members in the nature of left and right hand two-bay inboard diagonal braces, are indicated as **79**, **80**. Left and right hand three-bay diagonal braces are indicated as **81**, **82** with the upper ends of braces **81**, **82** overlapping at the upper region of central bay **84**.

In Figure **2b**, a car **83** is similar to car **70**, except insofar as an extra pair of two-bay diagonal braces **79**, **80** being employed in place of braces **81**, **82** with central bay **84** being free of diagonal bracing. In Figure **2c**, a center beam railroad car **85** is similar to car **70**, but rather than using overlapping three-bay braces, **81** and **82**, an additional tapered vertical post **86** is mounted at mid-span in central bay **84**, and a pair of two-and-a-half bay braces **87**, **88** meet at an upper portion of post **86**. In Figure **2d**, a car **90** is similar to car **85**, but a shear plate **91** is mounted in central bay **84**. In Figure **2e**, a center beam railroad car **92** is similar to cars **85** and **90**, but employs a single-bay diagonal brace **93**. In Figure **2f**, a center beam railroad car **94**, similar to cars **85**, or **90**, or **92**, employs a pair of crossed single-bay braces **93**, **95** in central bay **84**. Of these, the embodiment of Figure **2f** is preferred.

In all of cars **70**, **83**, **85**, **90**, **92** and **94**, staging, in the nature of false floors **96**, **98** is carried above the respective end deck portions. This staging is offset from the lading supporting structure of medial deck portion **29** by a height increment indicated as δ (Figure **4a**). In all of the embodiments illustrated in Figures **2a**, **2b**, **2c**, **2d**, **2e** and **2f**, the step increment corresponds to the height of a nominal 32 inch bundle of lumber, plus dunnage, (that is, 31 and ½ inches of lumber plus 1 and ½ inches of dunnage).

Figures **4a** and **4b** are half sectional views of center beam railroad car **70** taken, respectively, at cross-tie **41** of end deck portion **27** looking inboard parallel to centerline **25**, and at mid- span of medial deck portion **29**, looking toward the nearest adjacent cross-bearer **40**. The outline of AAR Plate **F** is indicated generally as **'F'**. A main center sill is indicated, as above, as **36**. It has an upper horizontal member in the nature of upper main flange **102**, and a pair of spaced apart vertical shear carrying members in the nature of left and right hand main sill webs **103**, **104**, thus forming three sides of a box. The fourth side of the box is formed by a lower horizontal member, in the nature of a main sill lower flange **106**. Lower flange **106** has an end portion, running along the outboard portion of main sill **36**, in a manner similar to a stub sill, indicated in Figure **3a** as **108** at a height for mounting upon truck **22** or **23** as the case may be. The rectangular female socket **28**

defined by the inner walls of items **102**, **103**, **104** and **108** is of a size and shape for receiving the male end of a coupler, such as coupler **38**.

As seen in Figure **3a** the inboard portion of lower flange **106** of main sill **36**, such as extends along medial deck portion **29**, is indicated as **107** and lies at a height relative to TOR that is below portion **108**. Lower flange portions **108** and **110** are joined by a smoothly swept transition section **109**, as indicated in phantom in Figure **3a**.

As seen in Figures **3a**, **4a**, and **4b**, in the medial, or drop deck portion of the car, indicated as **29**, there are cross-bearers, **40**, as noted above. The endmost cross bearer of portion **29** next to knee **47** is indicated as **112**. It is suspended from, and extends transversely to, main center sill **36**. Cross bearer **112** has a vertically standing web, **114**, and left and right hand upper flanges **115**, **116**. Flanges **115**, **116** lie flush, and co-planar, with the outboard extremities of lower flange portion **110**. (That is, flush with the portions of flange portion **110** that stand outwardly proud of vertical webs **103** and **104**). The join between flanges **115**, **116** and flange portion **110** is smoothly radiused.

Web **114** has left and right hand tapered portions **117**, **118**, and a continuous lower flange **120** that follows the profile of the lower edge of portions **117**, **118**. Longitudinal gussets **122**,**123** are placed between adjacent cross-bearers **112** to encourage the maintenance of parallelism between adjacent webs **114**. Each upper flange **115**, **116** of each cross bearer **112** has mounted on it a riser **124** that is tapered in profile, being shallowest closest to the car centerline **25**, and deepest at its outboard extremity so that lading borne thereon will tend to have an inward slant. The ends of upper flanges **115**, **116** and lower flange **120** are flared and radiused to meet the inner face of longitudinally extending medial side sill portion **126**. The upper flange **130** of side sill portion **126** lies flush, and co-planar with, upper flange **115**, (or **116** as may be), the outboard end of riser **124** overlying side sill flange **130**. Those portions of flange **110**, flange **115** (or **116**) and flange **130** that remain exposed provide a peripheral lap surface upon which floor sheets **127**, **128** can be welded, providing a shear connection between those elements.

As best seen in Figures **4a**, **4b** and **4e** medial side sill portion **126** has a channel like profile, having top or upper flange **130**, noted above, a bottom or lower flange **132**, and a back, or web, **134**. However, while top flange **130** and bottom flange **132** lie in parallel horizontal planes, web **134** does not stand perpendicular to them, and does not stand vertically perpendicular. Rather, web **134** is canted upward and outward at an angle

β measured from the vertical, such that flange **130** is displaced, or skewed, or stepped, outward relative to flange **132**. As seen in Figure **4a**, the extent of this outward positioning is such that both upper and lower flanges fall within the envelope of Plate **F**. A load securing device in the nature of a winch **138** is mounted to the outboard face of web **134** for tightening strapping **136** about the lading **137**. The slanted incline of web **134** permits the center of rotation of winch **138** to be drawn inward toward the center line of rail car **70** (or **20**, **83**, **85**, **90**, **92**, or **94** as the case may be), thus tending to permit the medial portion **29** of deck structure **26** to be carried at a lower height than otherwise.

The construction of end deck portion **28** (or **27**), is shown in Figures **3a**, **4a**, and **4d**. Main bolster **142** extends laterally outward from the main sill **36** at the longitudinal station corresponding to the truck center, whether of truck **22** or **23**, the car being symmetrical about its mid span transverse plane. The lower flange of bolster **142** is formed to follow an upwardly and outwardly stepped profile to clear the wheels of truck **22** (or **23**) through the turning envelope of the truck relative to the car generally. End deck structure **140** (Figure **3a**) includes a cross tie **146** located roughly 8 ft longitudinally outboard of main bolster **142**, (Figure **2a** and **4c**)cross tie **148** (Figure **2a**) located roughly 4 ft. longitudinally outboard of main bolster **142**, and cross tie **150** (Figure **2a**) located roughly 4 ft. longitudinally inboard of main bolster **142**. A side sill end portion is indicated as **152** (Figure **3a**), and extends along the transversely outboard, or distal, ends of main bolster **142**, and cross ties **146**, **148** and **150**.

In Figure **4d**, side sill end portion **152** also has the form of a skewed C-channel, having an outwardly and upwardly slanted web or back **154** having an upper edge and a lower edge, the upper edge lying further transversely outboard than the lower edge. Back **154** is inclined from the vertical at an angle ψ. ψ is less than β described above; a top flange **156** that is substantially level in a horizontal plane; and a bottom flange **158** that is parallel to top flange **156**, but inwardly inset according to the horizontal run of slanted back **154**. Winches **160** (not shown in Figure **3a**) are mounted at the longitudinal stations corresponding to main bolster **142** and cross ties **146**, **148**, and **150**.

A staging assembly, in the nature of a false floor is indicated generally as **170**. It includes lateral vertical web members in the nature of false floor webs **174**, **176**, **178** (Figure **2a**) and **180** mounted above, and at the longitudinal stations of, cross tie **146**, cross tie **148**, main bolster **142** and cross tie **150**. A false floor support, in the nature of an angle iron **182**, is mounted to the inboard wall face of end bulkhead **184** at a level

corresponding to the level of the upper edges of false floor web top flanges **185** (Figure **3a**) of false floor webs **174**, **176**, **178** and **180** (Figure **2a**). A vertically extending longitudinal false floor web **186** (Figure **3a**) is mounted above, and runs along, side sill end portion **152**. A floor sheet **188** is then welded above, and is supported by items **174**, **176**, **178**, **180** and **182**. Tapered risers, **190** (not shown in Figure **3a**), upon which lading can rest, are mounted above the respective laterally extending vertical web members. The incremental height distance of the rise from the load supporting interface of risers **124** (Figure **4a**) to the load supporting interface of risers **190** (Figure **4a**), measured perpendicular to the slope of risers **124**, **190**, corresponds to the height of a bundle of lumber, plus dunnage. In the preferred embodiment this incremental height is 33⅝" +/- ⅛", although it can be a lesser height, such as 30 inches with any discrepancy being made up by dunnage. Vertical webs, namely gussets **192**, **194** (Figure **3a**) are mounted between adjacent pairs of vertical posts to the level of the false floor as supports for the otherwise unsupported inner edge of floor sheet **188**. Covers **196** act as gussets filling the gaps between adjacent posts and gussets **192**, **194**.

Knee **49** is located at the transition, or step, between end portion **28** and medial deck portion **29**. Knee **47** is located at a mid-bay longitudinal station between the longitudinal stations of formed post **206** and fabricated post **208**. A laterally extending, generally horizontal transition flange **210** extends flush with, and between, main sill lower flange **107** and side sill medial portion upper flange **102**. At the same longitudinal station, a side sill end portion stiffener, in the nature of a rectangular tube **216**, is mounted to extend between center main sill **36** and the inboard end of side sill end portion **152**. A vertical wall member, in the nature of a well bulkhead sheet **220** is mounted to extend vertically upward from transition flange **210**, past the inboard end of side sill end portion **152** and rectangular tube **216**, up to the level of false floor sheet **188**. Sheet **220** terminates at its upward end in a formed flange **222**, which overlaps, and is welded to, sheet **188**. An inner tapered gusset **226** is located at the longitudinal station of transition flange **210** and extends between the inner face of medial side sill portion and the underside of transition flange **210**. Similarly, at the same longitudinal station, a side sill gusset **230** reinforces the section of side sill portion **126**.

As viewed from the side of car **70** as illustrated in Figure **3a**, knee **47** appears to have a longitudinally inboard vertical flange **232**, that is, the transversely outboard or distal margin of well bulkhead sheet **220**, and an outboard, angled flange **234** that faces, generally, toward truck **23**, with a web or webs extending between sheet **220** and flange

234. Flange 234 includes three aligned portions. The first, lowest portion is a side sill gusset member 236, that closes the end of side sill portion 126 and extends upwardly on a slant toward the lower or bottom flange 158 of side sill end portion 152, to a locus of intersection somewhat inboard of the longitudinal station of formed post 206. The line of member 236 is continued by side sill end portion gusset 238, which is slanted to lie within the flanges and back of side sill end portion 152, and by a false floor gusset 239, located on the same angle between the top flange of side sill end portion 152 and false floor sheet 188. A trapezoidal gusset 240 fills the void between the bottom flange 158 of portion 152, the upper or top flange 130 of the end of medial portion 126, sheet 220, and flange 234. When seen in end view, as in Figure 4a, flange 234, and the outboard edge of sheet 220, both follow an upwardly and outwardly angled profile, lying within Plate F. Providing an angled flange in this way, and thereby effectively deepening the width of section of vertical leg 232 of knee 47 may tend to increase the width of structure over which a moment couple generated in side sill medial portion 126 can be carried, thus tending to reduce the stress levels in the transition. Member 234 terminates, at its upward and outward end, at false floor support top flange 185. Upper main sill flange 102 is trimmed back flush with main sill side webs 103 and 104 in the well section or medial portion of the car so that a smooth face is presented next to the lading.

An alternative embodiment of end deck structure is shown in Figure 3b. Rather than employing a false deck mounted above the side sill end portion, a deeper side sill end section is employed. An end deck portion is indicated generally as 250. It includes a main bolster and vertical posts, both formed and fabricated, as above. A deep side sill end section 252 has a lower flange 254 at the same level as that of lower or bottom flange 158 of side sill end portion 152 described above (that is, at a height to clear the operational envelope of the adjacent truck 22 or 23). The upper flange 256 of section 252 is carried at the same height as the false floor top flange 185 described above. The vertical web 258 of section 252 then serves as the longitudinal outboard web of the staging, or false floor. In place of cross-ties 146, 148 and 150, and transversely oriented vertical false floor webs 174, 176, and 178, a transverse support 260 has a bottom flange 262, a vertical false floor web 264, and an upper flange 266. Bottom flange 262 is carried at an elevation equal to that of lower flange 254 of side sill end section 252 and upper flange 102 of main center sill 36.

In place of diagonal, angled flange 234, knee 270 has an inclined flange 272 that boxes in the end of medial side sill portion 274 and meets lower flange 254 of end section

252. Web 258 of side sill end section 252 has a knee, and a web stiffener 278 is run across the corner between upper and lower flanges 256, and 254. A boxed end stiffener 280 is used in place of rectangular tube 216, and a web 282 fills the space between well bulkhead sheet 220, side sill medial portion upper flange 130, inclined flange 272, and web stiffener 278. Web 258 and web 282 are portions of a single, monolithic port. As in the embodiment of Figure 3a, the tapered vertical leg that is created in this manner has a greater depth of section and may tend to be advantageous in carrying moment couples through the end deck to well deck transition. False floor sheets and risers are located as described above.

In Figure 3c, removable staging, or a removable false floor assembly 300, includes a conventional end decking structure medial side sill, and a series of removable lading support beams 304 upon which bundles of lumber can be carried. Each beam has an upper flange 306, a web 308, and a lower flange 310. Lower flange 310 carries attachment fittings in the nature of bolts 312 to permit it to be located at a longitudinal station abreast of respective ones of posts 314 and 316. Tapered risers 318 are separable, and have the same attachment fitting footprint as lower flange 310, so it can be re-applied to the conventional deck. Support beams 304 can be located in storage positions nested inside the flanges of posts 314 and 316, as desired.

In the further alternative embodiment of Figure 3d, a center beam rail road car 320 has a moveable decking end portion sheet indicated generally as 322. Sheet 322 is hinged at 324, 326 to permit rotation upward to lie in an up, or storage position against the outside face of posts 328 and 330. A collapsible support structure, in the nature of a set of diagonal links 332 and vertical struts 334 support sheet 322 when it is deployed in its down, or use, position. Links 332 and struts 334 are mounted to lugs 336 mounted on cross tie 338 and main bolster 340 respectively. Risers 342 are also mounted to cross tie 338 and main bolster 340, the height of risers 342 exceeding the height of lugs 336. Fenders 344 are mounted to the underside of sheet 322, and stand proud of those of lugs 336 that are also mounted to the underside of sheet 322, and to which the upper ends of links 332 and struts 334 mount.

In Figure 2g, a dropped deck center beam rail road car is indicated generally as 350. It has a web structure 352 and a top truss structure 354 substantially the same as those shown in Figure 2f. Car 350 differs from those described above as shown in the isometric view of Figure 3e and the sectional views of Figures 5a – 5e and the detail

views of Figures **6a** to **6e**. The main sill is indicated as **356**. It has a top cover plate **358**, left and right hand side webs **360**, **361**, and a bottom flange **364**, all welded in a box structure. Side webs **360** and **361** are tapered inward at the same angle, and in the same planes as, the flanges of the upright posts, **365**, **366**, so that there is slope continuity. Cross-bearers **368** are mounted transversely below main sill **356**, the web **370** of cross bearers **368** running beneath main sill **356** and having left and right hand portions extending to either side of main sill **356**, generally similar to the embodiment of Figure **4e** described above. Hollow structural members, in the nature of hollow steel tubes, identified as risers **374**, locate over the top flanges of cross-bearers **368**, each having an inboard end seated upon the upper side of bottom flange **364**, abutting respective side webs **360** and **361**.

Side sills **376** and **378** extend along the outboard ends of cross-bearers **368**. Side sills **376** and **378** have end portions **380** and **382**, and medial portions **384** (Figure **3e**). Medial portions **384** extend along the dropped deck portion of the car, and are, consequently, stepped downwardly relative to end portions **380** and **382**. As with side sills **126** and **152** described above, each of side sills **376** and **378** is skewed – that is, while the flanges are parallel, the lower side sill flange is stepped inboard relative to the upper side sill flange, and the back, or web, of the side sill is canted inward at an angle. Web **370** has a depth at its left and right hand outboard, or distal, extremities that corresponds to the depth of the side sill between the top and bottom flanges. The bottom flanges **369** of cross-bearers **368** extend outwardly such that the bottom flange of side sills **376** and **378** seat thereon. The winch arrangement is similar to that described above.

As above, the dropped deck portion of the deck ends at left and right hand knees, indicated as **392**, **394**. Other than being of opposite hands, they are of identical construction. The medial portion of the side sills, **384**, has been described above. The end portions **380** and **382** are formed from deep wide flanged beams. As noted above, the depth of the beam is determined at the lower flange by the height required to give adequate clearance over the wheels when the car is fully loaded and cornering, and the upper height limit of the upper flange is determined by the 33⅝" height increment at the step in the deck at knees **392** and **394**. Notably, there is no false floor. End portions **380** and **382** terminate, at their inboard ends at knees **392** and **394**, at a corner, **400**, that is enclosed with an angled end gusset **402** running on the diagonal between the upper and lower flanges of end portion **380** or **382**, as the case may be.

The upright portion, **404** of side sills **376** and **378**, have a front flange member **406** facing the well, a rear facing flange member **408** facing the adjacent truck, an irregular quadrilateral upper web portion **410** and a lower web portion **412**. Front flange member **406** is a substantially flat metal plate, and is mounted in a vertical plane. The metal plate is trimmed to provide smoothly radiused transitions to mate with an upper cross member **414**, a medial cross member **416**, and a bottom cross member **418**. At its lower extremity front flange member **406** has a sill engagement fitting, or seat, in the nature of a hook-shaped cut-out conforming to the inward profile of medial side sill member **384**. That is, the upper edge of the cut-out conforms to the top flange of the medial side sill portion, the outboard edge of the inwardly curving leg **422** conforms to the back, or web, of the medial side sill portion, and the smoothly curved toe **424** conforms to the bottom flange of the medial side sill. A gusset **426** seats within medial side sill portion **384**, in the plane of front facing flange member **406**, completing the section.

Rear facing flange member **408** is made from a bent plate cut to the desired profile. An upper leg **428** of member **408** runs downwardly from the end of the lower flange **427** of end side sill portion **380** (or **382**) on an angle along the edge of quadrilateral web member **410**. It bends downward into a lower leg **430** lying in a vertical plane at the longitudinal station of the end of the medial portion **384**. Member **408** also has an inwardly tending leg **432** cut to a similar profile to leg **422** and toe **424**, although having greater width when seen perpendicular to the vertically extending plane. A gusset **434** seats within the end section of side sill medial section **384** in the plane of leg **432**, in a manner similar to gusset **426**.

Lower cross-member **418** is an angle iron having one leg **436** trimmed to lie in a vertical plane, perpendicular to the longitudinal centerline of car **350**, between side web **360** (or **361**) of main sill **356** and the trimmed transition of forward facing member **406**. The other leg **435** of member **418** is trimmed to lie between, and be welded to, the outer edge of bottom flange **364** of main sill **356** and the juncture of the back or web, and upper flange of medial side sill portion **384**. A stringer in the nature of an upwardly opening channel **438** extends from a hangar bracket web mounting **437** on the underside of member **418** to the first cross-bearer **439** (Figure **2g**).

In this embodiment it will be noted that the cap, or upper flange of main sill **356** is carried at a height corresponding to the height of the upper, or end, deck portions.

Figure **5c** shows the deep main bolster **440** at section **5c- 5c**. As can be seen, left and right hand arms **442** and **444** of main bolster **440** have outer, or distal extremities **445** that have the same depth of section as side sill end portions **380, 382**. The root of main bolster **440** at the juncture of main sill **356** has a depth extending from the truck center plate mounting to the height of the upper deck. Main bolster **440** has inner shoulders **446**, and sloped intermediate portions **448** joining the inner and distal portions, with a stepped flange **450** extending fully along the lower edge of the bolster web. At this section, the tapered walls or webs, of main sill **356** are bracketed by two heavier, vertical plates **452, 454**. Plates **452** and **454** form the inner end of the end portion of the center sill **356**. A heavier top flange **456** forms the top plate of the end portion of main sill **356**.

Figures **5d** and **6d** show the penultimate cross-bearer **458** located at the longitudinal station between upright post **459** and main bolster **440**. A coupler pocket **464** is formed by welding a lower web **466** between plates **452** and **454**. Pocket **468**, and smoothly tapered cross member **460** are shown in Figure **5e**.

In the one embodiment, car **70** has a well deck portion that is 40 ft-6 in. long. The internal lading height of the well, that is, the nominal loading height of the bunk defined between the medial decking portion load bearing interface and the wings **65, 67** (Figure **7a**) of top truss **64** is 165 inches. As such, the height of top truss **64** from TOR, at roughly 16 ft-7 in., significantly exceeds the AAR Plate C maximum allowable height of 15 ft-6 in. The upper flange of main sill **36** is carried at a height, relative to TOR, that is high enough to permit the top surface of the coupler to fit within main center sill **36** as in a socket. The centerline coupler height is 34 ½ inches above TOR. For a Plate F car, the height of the top of the coupler head is roughly 40 ¾ inches above TOR for a car, as new, with un-worn wheels, unloaded. Thus the top surface height of a ¾" thick main center sill top flange is roughly 41 – 1/2 inches above TOR. In the case of the staging, or false floor structures described above, the level of the false floor sheeting and hence of all points on the associated tapered risers, is above the level of the top flange **102** of main center sill **36**, that is, at a level that is at least 42 inches from TOR. In the preferred embodiment of Figure **3a**, this height, taken at the truck centers, for a new car with no lading and un-worn wheels, is 12 – ½ inches above the level of the main sill, or roughly 53 – ½ inches above TOR (+/- 1 inch). Further, when loaded with 51 inch wide bundles of kiln dried softwood of a density of 1740 lbs per 1000 board feet, the fully loaded center of gravity of car **70** does not exceed 98 inches above TOR, that is, the center of gravity

falls within a range whose upper limit is 98 inches. Lesser volumes of higher density lumber up to 2000 Lbs. per 1000 board feet can also be carried.

Although a 40 ft., 6 in. medial deck, or well deck, is preferred, a shorter well deck could be employed, such as 28 ft. 6 in., 32 ft. 6 in., or 36 ft. 6 in., it being advantageous that the well deck be at least 28 ft. long.

Each of center beam cars **20**, **70**, **83**, **85**, **90**, **92** and **94** and **350** has an array of center beam web posts, indicated generally as **54** in the context of Figure **1**. Each of these arrays includes fabricated posts, having a generally H-shaped cross-section, and roll formed posts having a generally C-shaped cross-section. In the embodiments of Figures **2a**, **2b**, **2c**, **2d**, **2e**, **2f**, **3a**, **3b** and **3c**, while all of these posts are rooted to main center sill **36**, the posts mounted on the end portions of the respective railcars are formed to meld with main sill extensions, such as gussets **192** and **194**, (both Figure **3a**).

Other than as described above in the context of Figures **3a**, **3b**, **3c** and **3d**, a description of post **73** will serve also to describe the other posts having H-shaped cross-section in the various embodiments of rail road cars described herein. Similarly, a description of post **74** will serve to describe the other posts having C-shaped cross-sections in the various embodiments

Each of posts **73** has a central web **494** lying in a vertical plane perpendicular to the plane **24** of car **20** or car **70**, **83**, **85**, **90**, **92**, **94**, or **350**. Web **494** is tapered from a wide bottom adjacent main center sill **36** to a narrow top. At the outboard extremities of web **494** there are left and right hand flanges **496** and **498** (Figure **7a**) that each lie in a longitudinal plane inclined at an angle α defined (from the vertical) by the slope of the taper of web **494**. At the top of each post **73**, **74** web **494** has been trimmed back to a pair of tabs **500**, **502** at the ends of flanges **496**, **498**. This yields a seat, socket, relief, or rebate in the nature of a generally U-shaped notch or slot **504** into which top chord assembly **62** can seat.

A horizontal cross-section of post **73** will generally have an H-shape, with web **494** lying centrally relative to flanges **496** and **498**. Post **74**, by contrast, although tapered in a similar manner to post **474**, has a horizontal cross-section of a U-shaped channel, with its web being the back of the U, and the flanges being a pair of legs extending away from the back. Each diagonal member **58** (or **59** or struts **77**, **78** or braces **79**, **80**, **81**, **82**, **87**, **88**) has a first end rooted at a lower lug **97** welded at the juncture base of one of posts **73** adjacent to the juncture of post **73** with main center sill **36**, and a second diagonal end rooted in an

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upper lug **99** at the juncture of another adjacent post **73** and top chord assembly **62**. Midway along its length, diagonal beam **58** (or **59** or struts **77, 78** or braces **79, 80, 81, 82, 87, 88**) passes through post **74** intermediate the pair of posts **73** to which diagonal **58** (or **59** or struts **77, 78** or braces **79, 80, 81, 82, 87, 88**) is mounted. It is intended that the respective flanges of the various posts **73** and **74** lie in the same planes on either side of the central plane **24** of car **20** (or **70, 83, 85, 90, 92, 94, 350**) to present an aligned set of bearing surfaces against which lading can be placed.

The incline of flanges **496, 498** is roughly at right angles to the inward taper of risers **48**. This permits generally square cornered bundles to be stacked neatly in the clearance opening of the bunk defined between the underside of the top truss **64** and risers **48**.

In the embodiment of Figures **7a** and **7b**, upper beam assembly **510** can be defined as the combination of top chord assembly **62** and top truss **64**. It has a cross section in the shape, generally, of a 'T', with the cross-bar of the T being defined by wings **65** and **67** of top truss **64**, and the stem of the 'T' being defined by top chord assembly **62**, described more fully below.

Straps **136** (Figure **4a**) are provided to attach to the outboard, distal extremities of wings **65** and **67** of top truss **64**, to be wrapped outboard of the load, and to be tightened by a come-along, a winch, a pawl-and-ratchet type of mechanism, noted above as **138**, or similar tightening device mounted to the respective side sill **42** or **44**. An operator turns mechanism **138** with the aid of an extension bar or handle (not shown). When tightened, straps **136** bear against the outboard, upper corners of bundles indicated as **137**, tending to force their inboard, upper regions, indicated generally as **518**, most tightly against the upright center beam web structure of the railroad car that extends along plane of symmetry **24**, namely array **54** and the outer shank, or skirt, of the stem of upper beam assembly **60**.

The embodiment illustrated in Figures **7a** and **7b** has an inside loading clearance indicated as '**A**' of 169 3/8 inches perpendicular to risers **48**. It also has a loading limit indicated as '**B**' extending perpendicular to the slope of web **74**, at a height 163 ½ inches above, and measured perpendicular to, risers **48**. The nominal load height is then 165 inches for 5 bundles at 33 inches each, including dunnage. The nominal load height, in general, for 31 - ½ inch bundles of kiln dried lumber is thus the largest integer multiple of 33 inches that is less than the load limit height. In the illustrations of Figures **7a** and **7b**, **4a** and **4b**, this loading limit permits 51 inch wide bundles to fall within the loading envelope defined by AAR plate 'F'.

Deep beam section **510** is shown in cross-section in Figure **7a**. It includes a first, or upper formed section **540** in the shape of an inverted U, having a back **542** and left and right hand legs **544** , **546**. Legs **544**, **546** are splayed outwardly relative to the vertical at angle **α** to match the angle of the taper of the flanges of posts **73** and **74**. Upper formed section **540** also has inwardly stepped shoulders **541** and **543** to accommodate the mating ears of gusset plates **545** and **547** which join top truss **64** to top chord assembly **62**. Deep beam section **510** also includes a second formed section **550** that is generally U-shaped, having a back **552**, and a pair of left and right hand legs **554** and **555**. Legs **554** and **555** each have a proximal region **558**, **559** relative to back **552** that is stepped inwardly to form a shoulder **560** and a neck **562** of a size to nest between tabs **500**, **502** of post **73** or **74**, as the case may be. Tabs **500**, **502** are formed by trimming web **494** to conform to the depth of shoulder **560**. Legs **554**, **555** also each have an inwardly stepped toe **568**, **569** stepped inward a distance equal to the wall thickness of legs **554**, **555** such that toes **570**, **571** of legs **544**, **546** of member **540** can overlap, and seat outside of, outside toes **568**, **569** respectively, and be fillet welded in place. Legs **554** and **555** are angled inward to yield slope continuity with both legs **544** and **546** and also with flanges **496** and **498** of post **73** (or corresponding flanges of posts **74** as may be). That is, legs **554**, **555** are toed inward at the same angle from the vertical at which legs **544**, **546** are splayed outward so that the exterior surfaces are flush with, and lying in the planes of, the respective flanges of posts **73** and **74**. The exterior surfaces so defined can be termed skirts.

Gussets **572** and **574** are welded inside formed section **550** and **540** respectively at longitudinal stations along the length of car **20**, (or **70**, **83**, **85**, **90**, **92**, **94**, **350**) corresponding to the various longitudinal stations of the webs of posts **73** and **74** respectively, thus providing a substantially continuous web from main sill **36** to top truss **64**. There is, however, a web discontinuity between gusset **572** and gusset **574** indicated by gap '**G**', seen in Figure **7b**. In light of this discontinuity, gussets **572** and **574** have main web legs **576**, **577** that, when installed, lies in the vertical plane of web **494** and a toe **578**, **579** extending at a right angle therefrom, lying in a horizontal plane. The lateral edges of toes **578** and **579** are welded along the inside faces of toes **568**, **569** and **570**, **571** respectively and extend a distance comparable to the width between the respective toes at that point. In the preferred embodiment the overall height of top chord assembly **62** is 27 inches, with 1/4 inch wall thickness on legs **544**, **546**, **554** and **555**. In the preferred embodiment the length of legs **544**, **546** is 13 ½ inches, and the overall length of legs **554**, **555** is 14 ½ inches. Nominally, shoulder **560** overlaps tabs **500** and **502** by 2 inches. That is, tabs **500**, **502** extend 2 inches beyond web **494**. Toes **578** and **579** are both 6 inches long, and the nominal width of gap '**G**' is about 6 3/4 inches.

In this way, when assembled, legs **554**, **555** and **544**, **546** form respective left and right hand outwardly facing bearing surfaces against which a load may bear, and over which a reaction force to tension in the tightening straps can be spread. In the span between the stations of adjacent posts (whether **73** or **74**), the skirts, or bearing surfaces, formed in this way are reinforced by the laterally inward web, (that is, back **552**) which connects both skirts (that is, legs **544** and **554**, and legs **546** and **555**). The laterally inward reinforcement need not be immediately behind the respective skirt or facing, but rather can be offset, as illustrated in Figure **7a**, with the influence of the web stiffening the face some distance away. The web is "inward" of the skirts in the sense of lying behind, or shy of, the profile of the contact interface with the wood bundles, since the reinforcement lies toward the centerline of the rail car, rather than proud of, the respective skirt faces. In this way an inwardly disposed stiffener will not protrude and rub against an object bearing against the outwardly facing surface of the respective skirt.

In an alternative embodiment shown in Figures **8a** and **8b**, a deep beam section **590** has a pair of left and right hand formed sections **592**, **594** surmounted by a rectangular tube **596**, upon which top truss **64** is mounted. Each of sections **592**, **594** has a main sheet **600**, an inwardly stepped shoulder **602**, an inwardly extending leg **604** and an upturned toe **606**. In place of gussets **572** and **574**, section **590** has gussets **608**, **610** having a main, vertical leg **612**, **613** and a horizontal leg **614**, **615**. Vertical legs **612**, **613** are contoured to match the inside wall shape of formed sections **592**, **594** respectively, and are located at longitudinal stations to correspond to the longitudinal stations of the webs of posts **73** and **74** as above. Vertical legs **612**, **613** are separated by a vertically extending gap having a width '**H**'. Once gussets **608**, **610** are welded in place, formed sections **592**, **594** are welded along the seam where legs **604** of sections **592**, **594** abut along the centerline of car **20** or **70**, **83**, **85**, **90**, **92**, **94**, **350**. As above, the step in sections **592**, **594** is of a size to seat between tabs **500** and **502** of posts **73**, or **74**, and the distal tips of main sheets **600** are fillet welded to the side faces of tube **596**. As above, there is slope continuity between main sheets **600** and the corresponding flanges **496**, **498**.

In the alternative embodiment of Figures **9a** and **9b**, a deep upper beam assembly **620** has a pair of angle irons **622** and **624** welded longitudinally inside tabs **500** and **502** of posts **73** and **74**. Angle irons **622** and **624** each have an inwardly extending toe **626**, **627** which bottoms on the cut edge of web **494**, and an upwardly extending leg bent to conform to the slope of flanges **496** and **498**. Beam **620** also has a pair of left and right formed sections **628**, **629** each having a main sheet portion **630**, **631**, an inwardly extending leg **632**, **633** and a re-entrant toe **634**, **635**.

On assembly, L-shaped gussets **636, 637** are welded in each of sections **628, 629**. Gussets **636** and **637** each have a profile to match the inside profile of the upper regions of main sheet portions **630, 631**, legs **632, 633** and toe **634, 635**. The toes of gussets **636** and **637** are welded along their outboard edges to the inside face of main sheet portions **630, 631**. Sections **628** and **629** are welded along the centerline seam between abutting toes **634** and **635**. A further, main, gusset **640** is trimmed to a shape to permit welding of its top edge to the underside of the toes **638, 639** of gussets **636, 637**, its side edges to the inner face of the lower regions of main sheet portions **630** and **631**; once welded in this manner, the base leg **642** of gusset **640** can be welded to toes **626** and **627** of angle irons **622** and **624**, with a plug weld formed to fill the longitudinal gap therebetween. Gusset **640** is also trimmed to have reliefs **644, 645** to permit entry between the upwardly extending legs of angle irons **622, 624**. Gussets **636, 637** and **640** are located at longitudinal stations that correspond generally to the longitudinal stations of posts **56** and **57** as the case may be. Legs **632, 633** of sections **628, 629** form, ideally, a flat surface to weld to top truss assembly **64,** as before. Similarly, when installed, main sheet portions **630, 631** have slope continuity with flanges **496** and **498**.

In the alternative embodiment of Figures **10a** and **10b**, a deep upper beam **650** has a pair of formed sections **652, 654**, a rectangular steel tube **656**, a main gusset **658** and minor gussets **660** and **662**. On assembly, minor gussets **660** and **662** are welded inside the lower regions of formed section **652** and **654**, being shaped to conform to the shape of the lower region of outer main sheets **666, 668**, inwardly stepped shoulder **670, 672**, and inwardly extending legs **674, 676**. A gap '**P**' is left between the respective inboard edges of gussets **660** and **662**, and their outboard edges are welded to the inner face of main sheets **666, 668**. Gussets **660, 662** are trimmed to be clear of re-entrant toes **678, 680**. Main gusset **658** is welded upon minor gussets **660, 662**, with its lateral edges welded to the inside face of main sheets **652** and **654**. Tabs **682, 684** at the distal ends of main sheets **666, 668** embrace the outer side faces of steel tube **652**.

In the alternative embodiment of Figures **11a** and **11b**, a deep upper beam assembly **690** has a longitudinally extending inverted C-channel **692** upon which is welded a generally U-shaped formed section **694** having a back **696** and upwardly extending legs **698, 700** bent to lie on the slopes of the flanges of posts **73** and **74**, as above. The distal ends of legs **698** and **700** abut the lower edges of a pair of skirt plates **702** and **704**. A weld is formed along the abutting edges of the legs and skirts. At their furthest ends, skirt plates **702, 704** are welded to the outside faces of a steel tube **710**. Top truss assembly **64** surmounts assembly **690**. Minor gussets **706** are welded inside C-channel **692** at the longitudinal stations of posts **56** and **57,** as above, and gussets **708** are welded inside legs **698, 700** and plates **702, 704**

thereby providing a form to define the angular profile upon which they lie. As before, that profile is such as to yield a surface lying flush with the outer surfaces of posts **73** and **74.**

The alternate embodiment of deep beam **720** of Figures **12a** and **12b** is similar to that of Figures **11a** and **11b**, but differs insofar as C-channel **692** and formed section **694** have been combined into a singular formed section **722** having inwardly stepped shoulders **724** to yield a plug shaped head **726**, similar to that described in the context of Figures **7a**. Further, rather than straight legs **698** and **700**, formed section **722** has inwardly stepped toes **728** and **730**, again, similar to those shown in Figure **7a**. Skirt plates **732** and **734**, similar to skirt plates **702** and **704,** again extend between toes **728** and **730** to terminate on the outer side faces of a rectangular steel tube **736.**

In this instance a large gusset **738** is welded inside section **722,** and plates **732** and **734**. Gusset **738** has a vertical leg **740** having a profile cut to yield the desired slope continuity with the flanges of posts **73** and **74**.

The alternate embodiment of deep beam **750** of Figure **13** is similar to that of Figure **11a**. However, as in Figure **12a**, C-channel **692** and formed section **694** have been supplanted by a single formed section **752** having a back **754**, a pair of legs **756**, **758** having inwardly stepped shoulders and a pair of distal toes. A gusset **760** is mounted within formed section **752** at each of the longitudinal stations of car **20** corresponding to the longitudinal stations of the webs of posts **73** and **74**, as described above. However, gussets **760** terminate in a horizontal leg lying shy of the tips of the distal toes of legs **758** and **756** such that another formed section **762** can seat between them. Formed section **762** has a back **764**, legs **766**, **768** and shoulders **770**, **772**. An internal stiffener in the nature of a gusset **774** is located at each of the longitudinal post stations. Back **764** provides a horizontal web sufficiently close to top truss assembly **64** that no rectangular steel tube is employed. As before, the outer faces of legs **766**, **768** and legs **758**, **756** are intended to lie in the same planes as the flanges of posts **73** and **74**. The external faces of each of formed sections **752** and **762** each extend about a foot in depth, relative to top truss assembly **64**, and present, more or less, a 2 foot wide skirt, or band, that overlaps the load limit, and the maximum loading height.

In the embodiment of Figure **14**, a deep beam assembly **780** is generally similar to deep beam assembly **750**, but rather than have step-shouldered formed sections it has a C-channel **782** for mounting between tabs **500** and **502** as in Figure **11a** above, with gussets **784** mounted as described in Figure **11a**. Above this is a first pair of angle irons **786**, **788**, bent to present outer faces lying on the desired slope of the flanges of posts **73** and **74** as the

case may be. Formed angles **786, 788** are welded on a series of lateral gussets **790**, again, at the longitudinal stations of vertical posts **73** and **74**. Formed angles **786** and **788** are also butt welded to each other along the tips of their inwardly extending toes **792, 794**. Another pair of angle irons **800, 802** are welded on an array of gussets **804**, and along a butt welded seam at their inwardly extending toes **805, 806**, and mounted above angle irons **786** and **788**, as shown, such that their generally upwardly extending legs **808, 810**, and the consequent skirt-like surface they present, lie flush with, and on the same slopes as, the respective flanges of posts **73** and **74**.

The embodiment of Figure **15a** shows a half view of a retro-fit installation. (As the section is symmetrical about the center line of the car, only one half is illustrated.) An existing center beam post is shown as **820**. It has a web **822** trimmed down to leave tabs **824** and **826** which lie to either side of, and are welded to, a rectangular steel tube **825** upon which a top truss assembly **828** is mounted. A skirt panel **830** is formed with a stiffener in the nature of an inwardly bent toe **832**. The length of main leg **834** is roughly 2 feet, such that its outer face overlaps both the maximum load height and the load limit height. Toe **832** is trimmed to accommodate the flanges of post **820** (analogous to posts **56** or **57**). An additional reinforcement, or longitudinal stiffener, in the nature of angle **836** of a length to lie between successive posts **820**, is welded to the inner face of main leg **834** at an intermediate level roughly halfway between top truss assembly **828** and toe **832**. Angle **836** will tend to cause main leg **834** to resist lateral deflection between adjacent posts **820**, thereby tending to maintain main leg **834** in a position to spread loads placed against it.

Panel **830** could be as thick as 1/2 or 5/8 inches. Although panel **830** is preferably a metal sheet welded to posts **820**, a different fastening means, such as rivets, bolts or the like, could be used. A smooth steel face is preferred, but other metals, such as aluminum, could be used, or a suitable, rot resistant, UV resistant polymer could be selected, either as a solid sheet or as a face coating or layer, or sheet, upon a metal substrate. It is preferred that the material chosen be a non-consumable material, that is, one that may tend not to be prone to require frequent replacement such as may be required if softwood lumber battens are used, and also one that has little or no tendency to develop wood rot or to support the growth of molds

Panel **830** need not be integrally formed with bent toe **832**, but could be fabricated by using a flat sheet **840** as the external face plate, with an angle iron **842**, or similar stiffener, welded along the inward facing bottom edge of the face plate between pairs of posts **820**, as indicated in the other half view shown in Figure **15b**.

Figure **15c** is again a half section, showing a hollow cell panel **844** in place of panel **830**. Hollow cell panel **844** has an external skin **846**, an internal skin **848**, and an intermediate hollow cell core **847** for carrying shear between skins **846** and **848**. The hollow cells usually have a hexagonal columnar shape, the columns running perpendicular to the skins. The thickness of hollow cell panel **844** has been exaggerated for the purposes of illustration. Although skins **846** and **848** may be made of steel, they may also be made of other substances, such as structural polymers, reinforced polymers, aluminum, or other suitable material.

Figure **15d** is similar to Figure **15c**, but web **850** of post **852** has been trimmed back to permit outwardly facing external face **854** of hollow cell panel **856** to lie flush with flange **858** of post **852**. Hollow cell panel **856** is similar in construction to hollow cell panel **844**, having a pair of skins and a hollow core.

Figures **15e** and **15f** correspond to Figures **15c** and **15d** respectively, and illustrate the use of a corrugated core sandwich, either standing proud of the flange of the post, as illustrated by sandwich **849** in Figure **15e**, or flush with a trimmed down flange **851** as shown by sandwich **853** in Figure **15f**. The corrugated sandwiches have inner and outer metal skins, with a reverse folded, corrugated core maintaining the skins in a spaced apart, parallel planar relationship.

In each of the embodiments illustrated in Figures **15a**, **15b**, **15c**, **15d**, **15e** and **15f** the vertical extent of the skirt can be chosen according to the lading customarily carried by the car. As noted above, in general the skirt overlaps the nominal loading height, and extends a modest distance below the nominal loading height, whether 6 inches, 12 inches, 18 inches, 24 inches, 30 inches, or 36 inches. The skirt may also tend to overlap the maximum load limit height, and, further still, to be joined at a welded lap joint to the top chord, or top chord assembly.

The embodiment of Figure **16** shows a deep beam assembly **860** that is similar to deep beam assembly **780** of Figure **14** but does not have slope continuity with the flanges of posts **73** and **74**. Rather, the sides **862** and **864** of deep beam assembly **860** are parallel, and rise generally vertically. A channel **870** is welded along the back of pressing **872** to engage the notch formed in the upper end of post **73** (or **74**, as may be). A further U-shaped pressing **878** is welded above pressing **872**.

The embodiment of Figure **17** is similar to the embodiment of Figure **16**, except insofar as it has a single formed section **866** with shoulders **868** in lieu of a C-channel **870**

and section **862**. Similarly, its upper formed section **874** also has shoulders **876**, in contrast to upper section **878** of assembly **860**. Gussets are indicated as **880** and **882**.

In the embodiment of Figure **18** deep beam assembly **890** has an inverted U-shaped formed section **892** having parallel legs **894**, **896**. A notch has been cut in web **898** of post **900** such that a longitudinally extending rectangular steel tube **902** can seat between tabs **904** and **906** of flanges **908** and **910**. The distal tips **912** and **914** of legs **894** and **896** are welded along the side faces of tube **902**. In the embodiment of Figure **19** a formed section **920** is used in place of rectangular steel tube **902**. In the cases of both Figure **18** and Figure **19**, the overall depth of the side skirts defined by legs **894**, **896** or **922**, **924**, is roughly half that of the embodiments of Figures **7a**, **8a**, **9a**, **10a**, and **11a**, being roughly 1 ft. This width overlaps both the load limit height and the maximum load height.

In the embodiment of Figure **2f**, legs **544** and **546** extend from a root at the join to top truss **64**, to a level below the upper load limit. Legs **544** and **546** are roughly 24 inches long so that the bottom edge of legs **544** and **554** will extend down roughly half the height of the top bundle to act as a skirt against which a larger bearing area of the bundle can bear, as compared to the width of the flanges of the posts by themselves. The skirt has a mid level reinforcement between its upper and lower extremities, namely web stiffener **504** to discourage lateral deflection of the skirt, or bowing inward.

In alternative embodiments, the level of the bottom edge of the legs could be as little as one board (1 and 1/2 inches, kiln dried wood) below the top edge of the design bundle height, but is expected to be most commonly 12 inches, 24 inches (as in the preferred embodiment) or 30 inches deep when measured from the join to the top truss.

It is possible to manufacture a generally similar center beam car to fall within the loading profile defined by AAR plate 'F', or some other height. In that case, the desired load limit height is the height that is the largest integer multiple of 33 that is less than the clearance opening. The minimum height of the bottom edge of the leg, or skirt, is desirably 1 and 1/2 inches or more below the nominal load height, typically such that the overall height of the skirt is, nominally, an integer multiple of 6 that is at least 12 inches. Preferably, the skirt extends to a height that is at least half way down the top bundle of the nominal design load, and possibly to a height that is the full depth of the top bundle.

Although the main deck could be a continuous decking structure, this need not necessarily be so. The main deck, or lower beam structure could be in the form of an open truss, or grid work. Car **20**, and the other rail road cars described herein, are preferably of

all-steel construction. However, although the web work assembly of the center beam, and the top truss section is preferably a welded steel fabricated structure, it could be made of aluminum.

Various embodiments of the invention have now been described in detail. Since changes in and or additions to the above-described best mode may be made without departing from the nature, spirit or scope of the invention, the invention is not to be limited to those details, but only by the appended claims.